INDUSTRIAL STRATEGY | UK Research and Innovation

UK SPACE AGENCY

UNIVERSITY OF SURREY | Imperial College London

THE UNIVERSITY OF EDINBURGH

UNIVERSITY OF LIVERPOOL

University of Salford MANCHESTER

WARWICK THE UNIVERSITY OF WARWICK

FAIR-SPACE

# A Model Based Reinforcement Learning approach for Control of Free-Floating Spacecraft Manipulators

Dr. Ash Babu
University of Surrey
a.rajendrababu@surrey.ac.uk

# Introduction

## Recent proposals/developments

- e.Deorbit by ESA
  - Harpoon, nets, robotic arms and tentacles
- CleanSpace One by Swiss
  - To move decommissioned SwissCube nanosatellite out of orbit
- Electrodynamic tether by Japanese AEA
- Sling-Sat Space Sweeper by Texas A&M
- CubeSail by University of Surrey

# Research Question

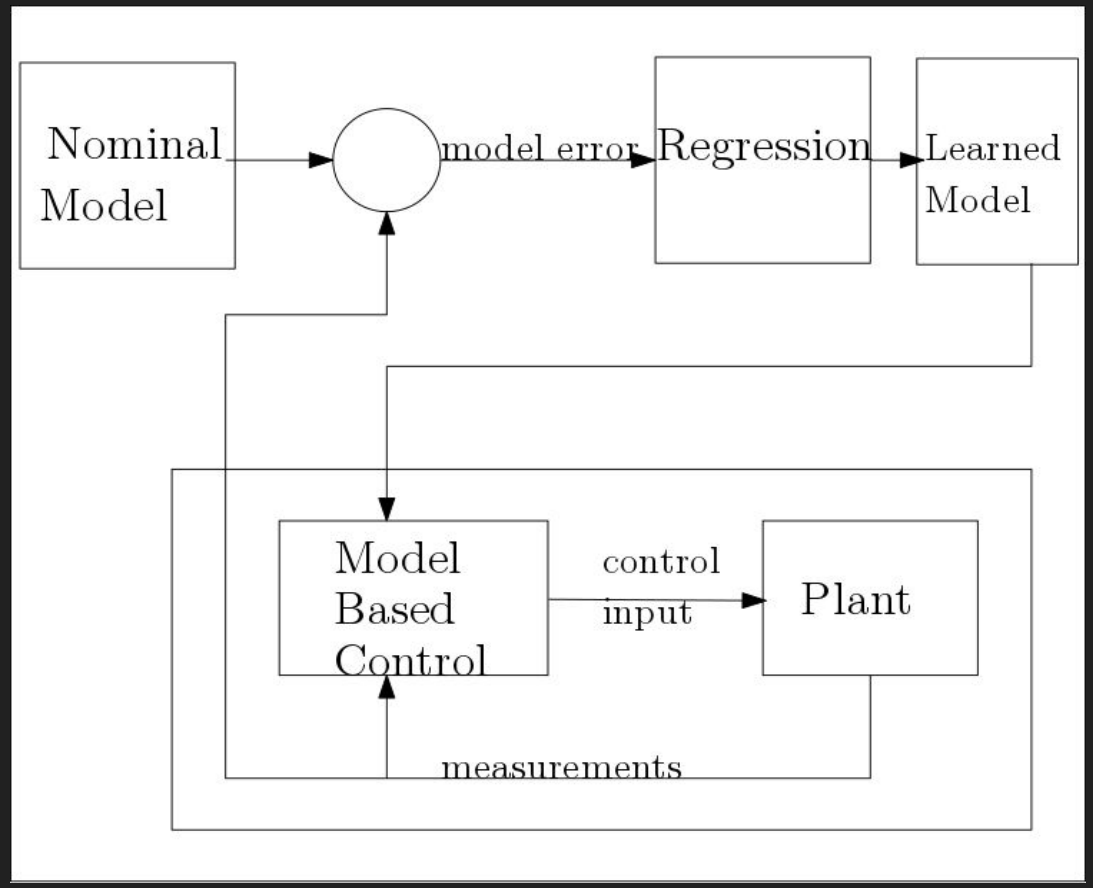
How to give more autonomy for future space missions in dealing with *debris removal, on-orbit servicing, rendezvous & docking* etc.

https://www.space.com/40960-removedebris-space-junk-cleanup-test-flight.html

Working on the case of free-floating spacecrafts for debris removal

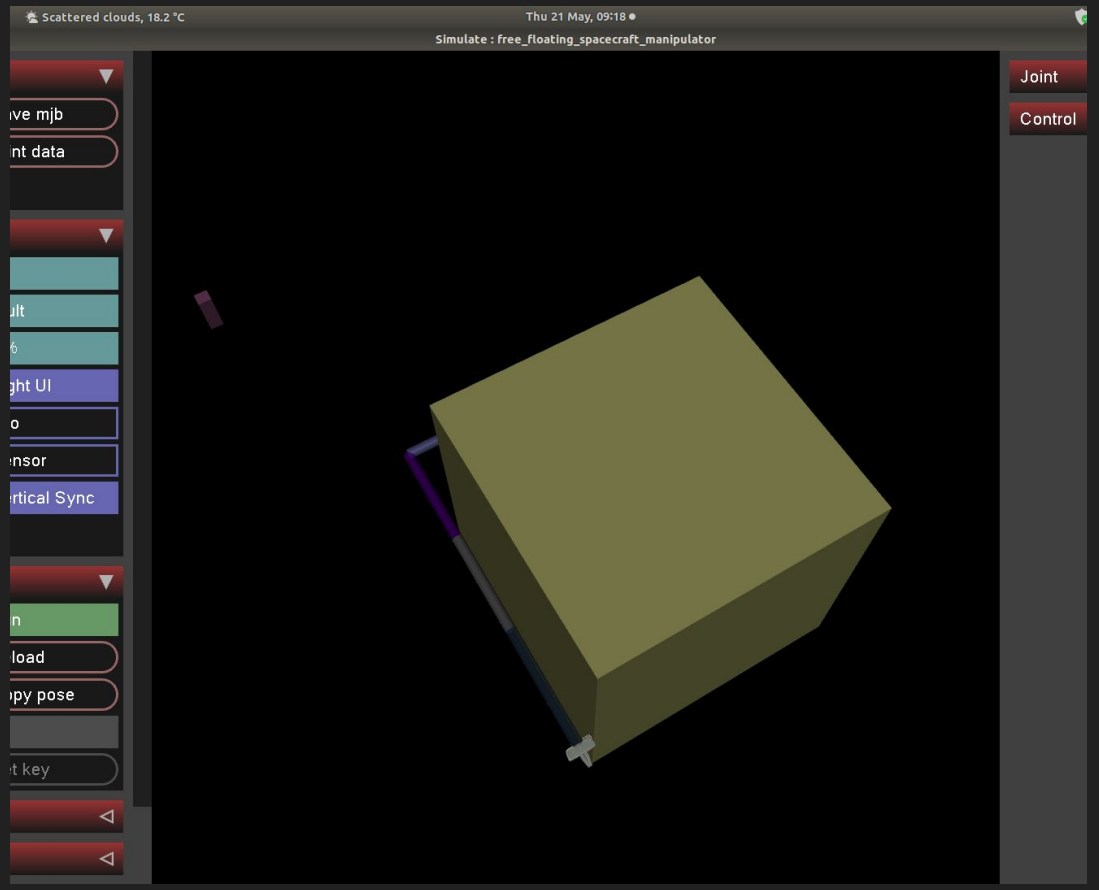
# Possible solutions

- Learn the model online with model based Reinforcement Learning



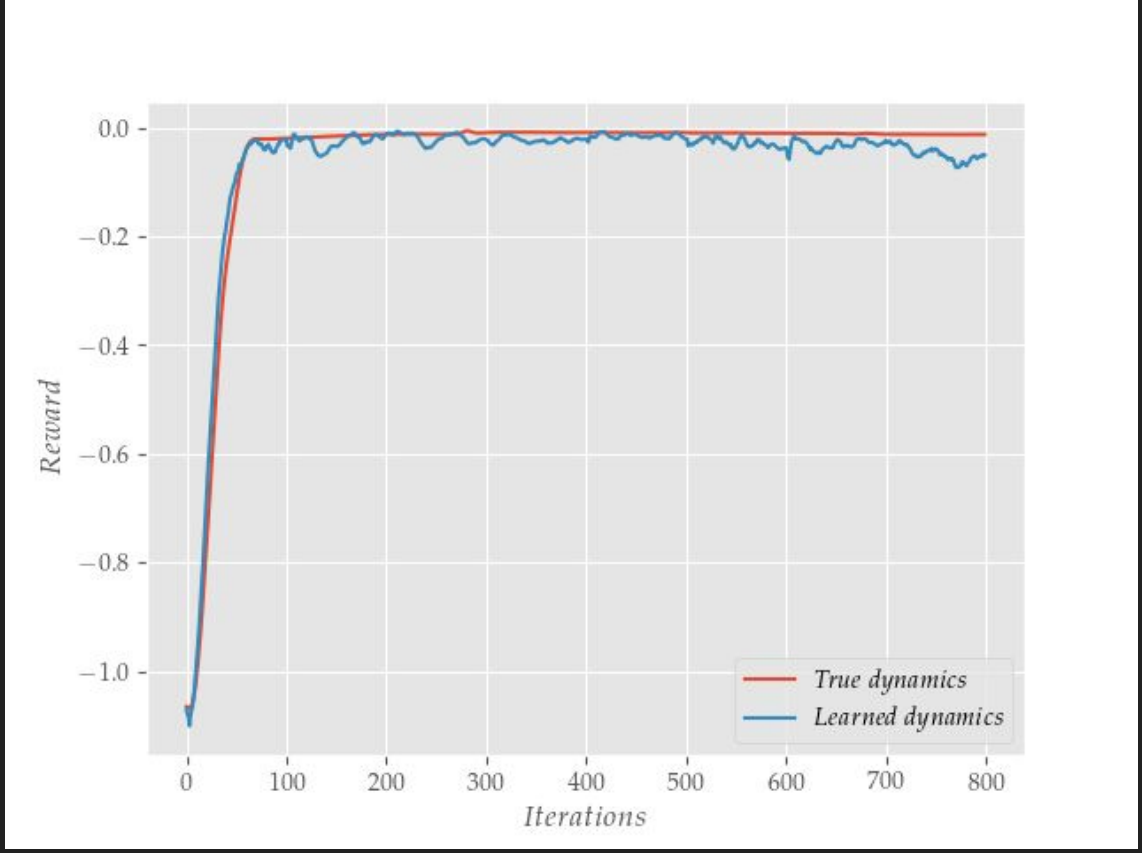
# Preliminary RL experiments

- Reinforcement learning environment set up done with MuJoCo + gym
- Model-free (DDPG) takes long and sample inefficient
- Created a python package for RL learning
-



# Results

- Model Based RL of reaching a target



# Results

- 

INDUSTRIAL STRATEGY | UK Research and Innovation

UK SPACE AGENCY

UNIVERSITY OF SURREY

Imperial College London

THE UNIVERSITY OF EDINBURGH

UNIVERSITY OF LIVERPOOL

University of Salford MANCHESTER

WARWICK THE UNIVERSITY OF WARWICK

FAIR-SPACE

# Questions/Suggestions/Collaborations?

# Thank You

Dr. Ash Babu
Surrey Space Center
a.rajendrababu@surrey.ac.uk